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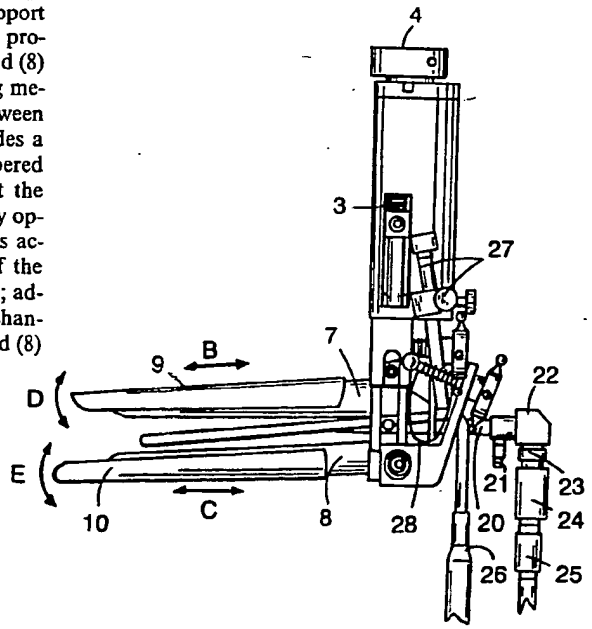
*With amended claims.*

(54) Title: PERCUTANEOUS SURGICAL ENDOSCOPY

(57) Abstract

The invention includes a multiple action surgical endoscopic instrument comprising first (7) and second (8) blades. A support carries first (15) and second (16) adjusting mechanisms which provide independent angular adjustment of the first (7) and second (8) blades, respectively. The support also carries a third adjusting mechanism (4) which provides adjustment of the separation between the first (7) and second (8) blades. The invention also includes a diagnostic surgical endoscopic instrument comprising a tapered tube (31) and a handle (35) which is detachably secured at the proximal end of the tube (31) to a selected one of diametrically opposed positions relative to the axis of the tube (31). A process according to the invention includes inserting the distal ends of the first (7) and second (8) blades through an incision in a patient; adjusting the first (15), second (16), and third (4) adjusting mechanisms; and inserting instruments through the first (7) and second (8) blades and the incision into the patient.



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# PERCUTANEOUS SURGICAL ENDOSCOPY

This invention relates to percutaneous surgical endoscopy.

According to one aspect of the invention, a multiple action surgical endoscopic instrument comprises first and second blades having distal and proximal ends and support for the first and second blades. The support carries first and second adjusting mechanisms which provide independent angular adjustment of the first and second blades, respectively. The support also carries a third adjusting mechanism which provides adjustment of the separation between the first and second blades.

According to one aspect of the invention, a diagnostic surgical endoscopic instrument comprises a tube having an axis, distal and proximal ends, and a support for the tube. A handle is attached to the instrument at the proximal end. One important feature of the diagnostic surgical endoscopic instrument is that the tube is tapered at the distal end. Another important feature of the diagnostic endoscopic surgical instrument is that the handle is detachably secured to the instrument in a selected one of diametrically opposed positions relative to the axis of the tube.

A process according to the invention includes the steps of making an incision in a patient of width corresponding substantially to that of the first and second blades; inserting the distal ends of the first and second blades through an incision; adjusting the first, second, and third adjusting mechanisms; and inserting instruments through the first and second blades and the incision into the patient.

According to one aspect of the invention, the invention includes a vessel ligating device. The vessel ligating device comprises a wire for ligating a vessel

and a plate with two ports through which the wire can pass. The vessel ligating device also includes a tightening device for tightening the wire around the vessel and a stabilizing point for controlling movement of the vessel.

The above structural arrangements allow insertion of the endoscopic surgical instrument through a relatively small percutaneous incision with adequate lighting of the internal region while allowing independent control of the endoscopic surgical instrument through flexible axial positioning of the blades during surgery. In addition, the movable light rod is movable axially, transaxially, and pivotally allowing the surgeon to control illumination of the surgical treatment region. The movable light rod also acts as a retractor. The diagnostic endoscopic surgical instrument has the advantage of a detachable handle capable of being attached above or below the tapered tube.

The endoscopic surgical instrument and diagnostic endoscopic surgical instrument may be used in the chest, thoracic cavity, and abdominal cavity, or in other regions for less invasive surgery.

Other features, objects, and advantages of the invention will become apparent from the following description when read in connection with the accompanying drawings in which:

FIG. 1 is a rear elevational view of the surgical endoscope with the retractor blades in the enclosed position;

FIG. 1a is a rear view at the optional light pipe holder and securing screw;

FIG. 2 is a side elevational view of the surgical endoscope of FIG. 1;

FIG. 2a is a side view of the optional double prism for inverting and offsetting the image;

FIG. 3 is a side elevational view of the diagnostic surgical endoscopic instrument;

FIGS. 4a-4d show side and top views of one embodiment of a vessel ligating device; and

FIGS. 5a-5c show side and top views of another embodiment of a vessel ligating device.

Referring to FIGS. 1 and 2, one embodiment of a surgical endoscope shows an endoscope handle 1 having a round slot 2 for insertion of a securing arm (not shown) with joints that are attachable to an operating table. A lead screw 3 with a lead screw knob 4 adjust the opening between the first and second retractor blades, 7 and 8, respectively, along the path indicated by arrow A. A fork 5 is connected to first retractor blade 7. First retractor blade extension 9 is movable axially in directions indicated by arrow B. A fork 6 holds adjustable first and second retractor blades, 7 and 8, respectively. Second retractor blade extension 10 is movable axially in directions indicated by arrow C. First and second retractor blades, 7 and 8, respectively, may be of varying lengths and widths. Lead screws, 11 and 12, respectively, move first and second retractor blade extensions, 9 and 10, respectively, in directions B and C, respectively, by the use of a torque wrench. Set screws 11a and 12a with annular slots are threaded through set screw collars 11b and 12b, respectively, secured to the outside of first and second retractor blades, 7 and 8, respectively, on adjusting lead screws, 11 and 12, respectively.

First and second retractor blade positioning plates, 14 and 13, respectively, pivot first and second retractor blades, 7 and 8, respectively, along paths D and E, respectively, with first and second retractor blade positioning screws, 15 and 16, respectively. Left and right second retractor blade hinge screws, 17 and 18,

respectively, secure second retractor blade 8 to second retractor blade positioning plate 13. Securing screw 19 secures the horizontal and vertical hinge movement of optical telescope 20, micro-video camera 24, and fiber lighting (not shown) to the support. Prism arrangement 22 inverts and offsets the image through the optical telescope as explained below.

Connector 21 connects fiberoptics light pipe 26 to the instrument. Adjustable lens 23 focuses the image provided by optical telescope 20 to micro-video camera 24. Cable and cable connector 25 connects the micro-video camera 24 to a micro-video monitor (not shown). Fiberoptics light pipe holder and positioner 27 holds and positions fiberoptics light pipe 26. A flat spring 28 balances second retractor blade 8. A second flat spring (not shown) balances first retractor blade 7.

In addition, the surgical endoscopic instrument preferably has a detachable plastic disposable light carrier end for safer use in the chest cavity and a moveable light rod.

In one embodiment the surgical endoscopic instrument has one light pipe 26 on one side and one optical telescope 20 connected to a micro-video camera 24 on the other side. In another embodiment the surgical instrument has two light pipes 26 and no optical telescope 20 or micro-video camera 24.

Referring to FIG. 1a, an optional light pipe holder 29 with securing screw 27a is provided.

Referring to FIG. 2a, an optional double prism 22a inverts and offsets the image through the optical telescope.

Referring to FIG. 3, handle 35 is detachably attached to either handle mount 33 or handle mount 36. Tube 31 is tapered at its distal end and has a beveled distal opening 30 allowing viewing, with the wall

opposite opening 30 restricting trochar (probe) travel. Fiber optics light pipe extensions 26a are connected to fiber optics light pipes 26. Optical telescope channel 32 is connected to optical telescope inlet 37. Prism arrangement 22 inverts and offsets the image and adjustable lens 23 focuses the image to micro-video camera 24. Cable and cable connector 25 connects micro-video camera 24 to a micro-video monitor (not shown).

Referring to FIGS. 4a-4d, the surgical endoscopic instrument may be used, for example, in concert with a ligating wire 41 passed through annular ports 39 and plate 38 around vessel V. A stabilizing point 40 controls the movement of vessel V. The ligating wire 41 is pulled tight around vessel V and secured to annular ports 39 with crimping indents 42.

Referring to FIGS. 5a-5c, the surgical endoscopic instrument may also be used, for example, in concert with a ligating wire 46 passed through ports 44 in plate 43. A stabilizing point 45 controls the movement of vessel V. The ligating wire 46 is anchored through one of ports 44 on plate 43 with knot 47 and is tightened around vessel V through the second of ports 44 by pulling wire 46 and successively notching one-way triangular anchors 48 on plate 43.

Other embodiments are within the claims.

What is claimed is:

Claims

1. A multiple action surgical endoscopic instrument comprising:

first and second blades having distal and proximal ends;

support for said first and second blades;

said support carrying first and second adjusting mechanisms providing independent angular adjustment of said first and second blades respectively;

said support carrying a third adjusting mechanism for providing adjustment of the separation between said first and second blades.

2. The endoscopic surgical instrument of claim 1 and further comprising fourth and fifth adjusting mechanisms for independently adjusting the lengths of said first and second blades.

3. The endoscopic surgical instrument of claim 1 and further comprising a viewing device carried by said support for viewing a cavity into which said endoscopic surgical instrument is placed.

4. The endoscopic surgical instrument of claim 1 and further comprising an illumination device carried by said support for illuminating a cavity into which said endoscopic surgical instrument is placed.

5. The endoscopic surgical instrument of claim 1 where said first adjusting mechanism comprises first and second blade positioning plates, first and second blade positioning screws, and first and second blade balancing flat springs.

6. The endoscopic surgical instrument of claim 5 where said first adjusting mechanism further comprises a hinge for pivotally moving said second blade and hinge securing screws for securing said second blade to said support.

7. The endoscopic surgical instrument of claim 1 where said second adjusting mechanism comprises a first fork connected to said first blade, a second fork connected to said second blade, a first lead screw for providing separation between said first and second blades, and a first lead screw knob.

8. The endoscopic surgical instrument of claim 1 where said first blade has a first blade extension with a tapered distal end and is movable axially along said first blade.

9. The endoscopic surgical instrument of claim 1 where said second blade has a second blade extension with a rounded distal end and is movable axially along said second blade.

10. The endoscopic instrument of claim 1 where said handle comprises a round slot for insertion of a jointed securing arm attachable to an operating table.

11. The endoscopic surgical instrument of claim 3 where said viewing device comprises at least one micro-video camera cable and micro-video camera cable connector, at least one optical telescope, at least one micro-video camera, at least one adjustable lens between said optical telescope and said micro-video camera, and

at least one optical inversion device to optically invert an image provided to said viewing device.

12. The endoscopic surgical instrument of claim 11 where said optical inversion device is a double prism.

13. The endoscopic surgical instrument of claim 4 where said illumination device comprises a fiberoptics light pipe connector, a fiberoptics light pipe, a fiberoptics light pipe holder and positioner, and a movable light rod.

14. The endoscopic surgical instrument of claim 1 and further comprising a handle carried by said support.

15. A diagnostic surgical endoscopic instrument comprising:

a tube having an axis and distal and proximal ends;

a support for said tube;

a handle attached to said instrument at said proximal end.

16. The diagnostic surgical endoscopic instrument of claim 15 where said tube is tapered at said distal end.

17. The diagnostic surgical endoscopic instrument of claim 15 provided with a viewing device for viewing a cavity into which said diagnostic endoscopic surgical instrument is placed.

18. The diagnostic surgical endoscopic instrument of claim 15 provided with an illumination device for

illuminating said cavity into which said diagnostic endoscopic surgical instrument is placed.

19. The diagnostic endoscopic surgical instrument of claim 17 where said viewing device comprises at least one micro-video camera cable and micro-video camera cable connector, at least one optical telescope, at least one micro-video camera, at least one adjustable lens between said optical telescope and said micro-video camera, and at least one optical inverting device to rotate an image provided to said viewing device.

20. The diagnostic endoscopic surgical instrument of claim 19 where said optical inverting device is a double prism.

21. The diagnostic endoscopic surgical instrument of claim 18 where said illumination device comprises a fiberoptics light pipe connector, a fiberoptics light pipe, a fiberoptics light pipe holder and positioner, and a movable light rod.

22. The diagnostic endoscopic surgical instrument of claim 15 where said handle is detachably secured to said instrument in a selected one of diametrically opposed positions relative to the axis of said tube.

23. A surgical method using the instrument of claim 1 which method includes the steps of:

making an incision in a patient of width corresponding substantially to that of said first and second blades;

inserting the distal ends of said first and second blades through said incision;

adjusting said first, second, and third adjusting mechanisms;

and inserting instruments through said first and second blades and said incision into said patient.

24. The method of claim 23 and further comprising ligating a vessel which includes the steps of:

surrounding a vessel with a ligating wire;

pulling said wire through two portals in a plate;

tightening said wire around said vessel by use of a tightening device;

controlling movement of said vessel by use of a stabilizing point on said plate.

25. A vessel ligating device comprising:

a wire for ligating a vessel;

a plate with two ports through which said wire can pass;

a tightening device for tightening said wire around said vessel;

a stabilizing point for controlling movement of said vessel.

26. The vessel ligating device of claim 25 where said ports are of annular form.

27. The vessel ligating device of claim 25 where said tightening device comprises crimping said wire to said annular ports after tightening said wire around said vessel.

28. The vessel ligating device of claim 25 where said wire for ligating said vessel is knotted and comprises triangular anchors attached thereto for anchoring said wire to said plate.

AMENDED CLAIMS

[received by the International Bureau on 19 August 1993 (19.08.93) ;
original claims 1-28 replaced by
amended claims 1-28 (6 pages)]

1. A multiple action surgical endoscopic instrument comprising:

first and second blades having distal and proximal ends;

support for said first and second blades;

each of said first and second blades having a pivot point between said distal and proximal ends and a lever arm between its pivot point and proximal end angularly displaced from the blade portion between its pivot point and distal end and being pivotally attached to said support at its pivot point;

said support carrying first and second adjusting mechanisms providing independent angular adjustment of said first and second blades respectively;

each of said first and second adjusting mechanisms comprising an angle-adjusting screw connected between said support and a respective proximal end constructed and arranged so that rotation of an angle-adjusting screw adjusts the angle of the associated blade about the associated pivot point to a desired angle that persists when rotation stops to maintain a stable angular orientation of the blades;

said support carrying a third adjusting mechanism for providing adjustment of the separation between said first and second blades.

2. The endoscopic surgical instrument of claim 1 and further comprising fourth and fifth adjusting mechanisms for independently adjusting the lengths of said first and second blades.

3. The endoscopic surgical instrument of claim 1 and further comprising a viewing device carried by said support for viewing a cavity into which said endoscopic surgical instrument is placed.

4. The endoscopic surgical instrument of claim 1 and further comprising an illumination device carried by said support for illuminating a cavity into which said endoscopic surgical instrument is placed.

5. The endoscopic surgical instrument of claim 1 where said first and second adjusting mechanisms comprise first and second blade positioning plates comprising said lever arms, first and second blade positioning screws, and first and second blade balancing flat springs.

6. The endoscopic surgical instrument of claim 5 where each of said first and second adjusting mechanisms further comprises a hinge and hinge securing screw[s] for securing each blade to said support.

7. The endoscopic surgical instrument of claim 1 where said third adjusting mechanism comprises a first fork connected to said first blade, a second fork connected to said second blade, a first lead screw for providing separation between said first and second blades, and a first lead screw knob connected to said first lead screw.

8. The endoscopic surgical instrument of claim 1 where said first blade has a first blade extension with a tapered distal end and is movable axially along said first blade.

9. The endoscopic surgical instrument of claim 1 where said second blade has a second blade extension with a rounded distal end and is movable axially along said second blade.

10. The endoscopic instrument of claim 14 where said handle comprises a round slot adapted for insertion of a jointed securing arm attachable to an operating table.

11. The endoscopic surgical instrument of claim 3 where said viewing device comprises at least one micro-video camera cable and micro-video camera cable connector, at least one optical telescope, at least one micro-video camera, at least one adjustable lens between said optical telescope and said micro-video camera, and

at least one optical inversion device to optically invert an image provided to said viewing device.

12. The endoscopic surgical instrument of claim 11 where said optical inversion device is a double prism.

13. The endoscopic surgical instrument of claim 4 where said illumination device comprises a fiberoptics light pipe connector, a fiberoptics light pipe, a fiberoptics light pipe holder and positioner, and a movable light rod.

14. The endoscopic surgical instrument of claim 1 and further comprising a handle carried by said support.

15. A diagnostic surgical endoscopic instrument comprising:

a tube having an axis and distal and proximal ends;

a support for said tube;

a handle attached to said instrument at said proximal end.

16. The diagnostic surgical endoscopic instrument of claim 15 where said tube is tapered at said distal end.

17. The diagnostic surgical endoscopic instrument of claim 15 provided with a viewing device for viewing a cavity into which said diagnostic endoscopic surgical instrument is placed.

18. The diagnostic surgical endoscopic instrument of claim 15 provided with an illumination device for

illuminating said cavity into which said diagnostic endoscopic surgical instrument is placed.

19. The diagnostic endoscopic surgical instrument of claim 17 where said viewing device comprises at least one micro-video camera cable and micro-video camera cable connector, at least one optical telescope, at least one micro-video camera, at least one adjustable lens between said optical telescope and said micro-video camera, and at least one optical inverting device to rotate an image provided to said viewing device.

20. The diagnostic endoscopic surgical instrument of claim 19 where said optical inverting device is a double prism.

21. The diagnostic endoscopic surgical instrument of claim 18 where said illumination device comprises a fiberoptics light pipe connector, a fiberoptics light pipe, a fiberoptics light pipe holder and positioner, and a movable light rod.

22. The diagnostic endoscopic surgical instrument of claim 15 where said handle is detachably secured to said instrument in a selected one of diametrically opposed positions relative to the axis of said tube.

23. A surgical method using the instrument of claim 1 which method includes the steps of:

making an incision in a patient of width corresponding substantially to that of said first and second blades;

inserting the distal ends of said first and second blades through said incision;

adjusting said first, second, and third adjusting mechanisms;

and inserting instruments through said first and second blades and said incision into said patient.

24. The method of claim 23 and further comprising ligating a vessel which includes the steps of:

surrounding a vessel with a ligating wire;

pulling said wire through two portals in a plate;

tightening said wire around said vessel by use of a tightening device;

controlling movement of said vessel by use of a stabilizing point on said plate.

25. A vessel ligating device comprising:

a wire for ligating a vessel;

a plate with two ports through which said wire can pass;

a tightening device for tightening said wire around said vessel;

a stabilizing point for controlling movement of said vessel.

26. The vessel ligating device of claim 25 where said ports are of annular form.

27. The vessel ligating device of claim 25 where said tightening device comprises crimping said wire to said annular ports after tightening said wire around said vessel.

28. The vessel ligating device of claim 25 where said wire for ligating said vessel is knotted and comprises triangular anchors attached thereto for anchoring said wire to said plate.

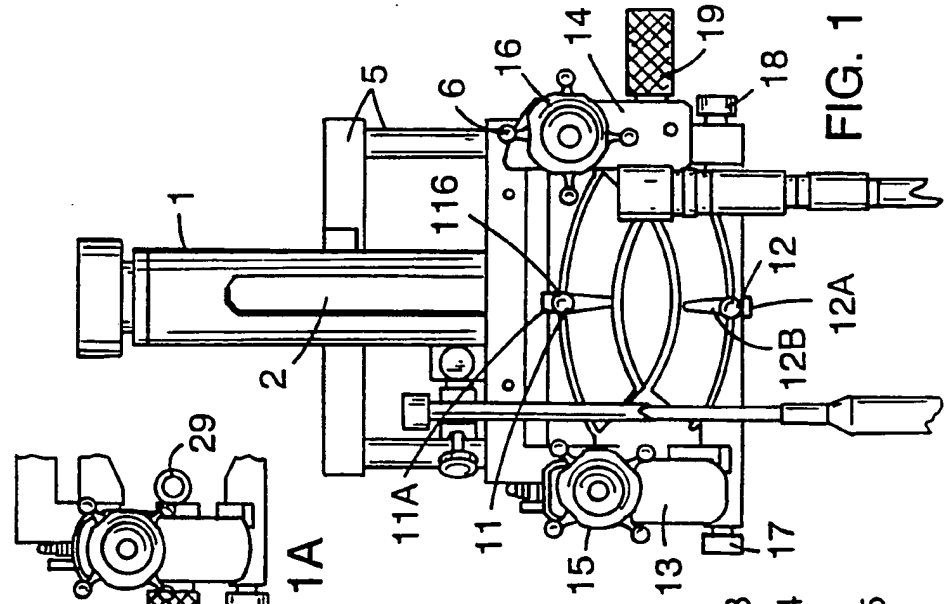


FIG. 1




FIG. 1A

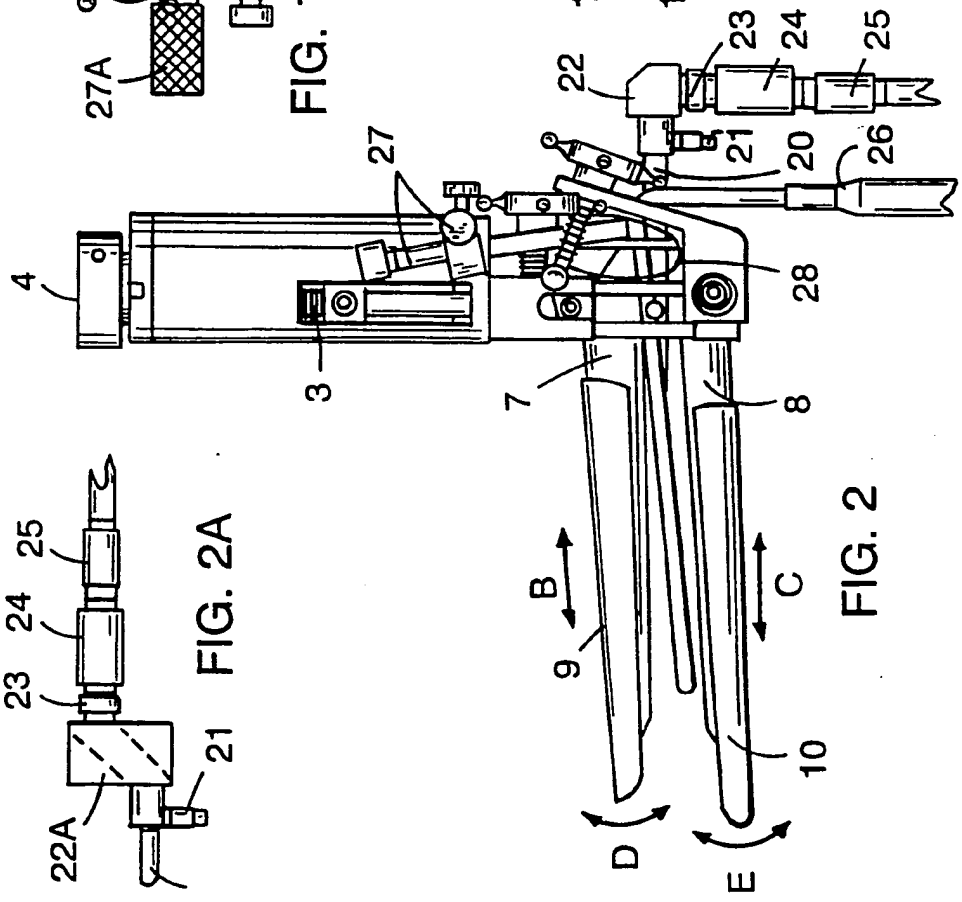


FIG. 2




FIG. 2A

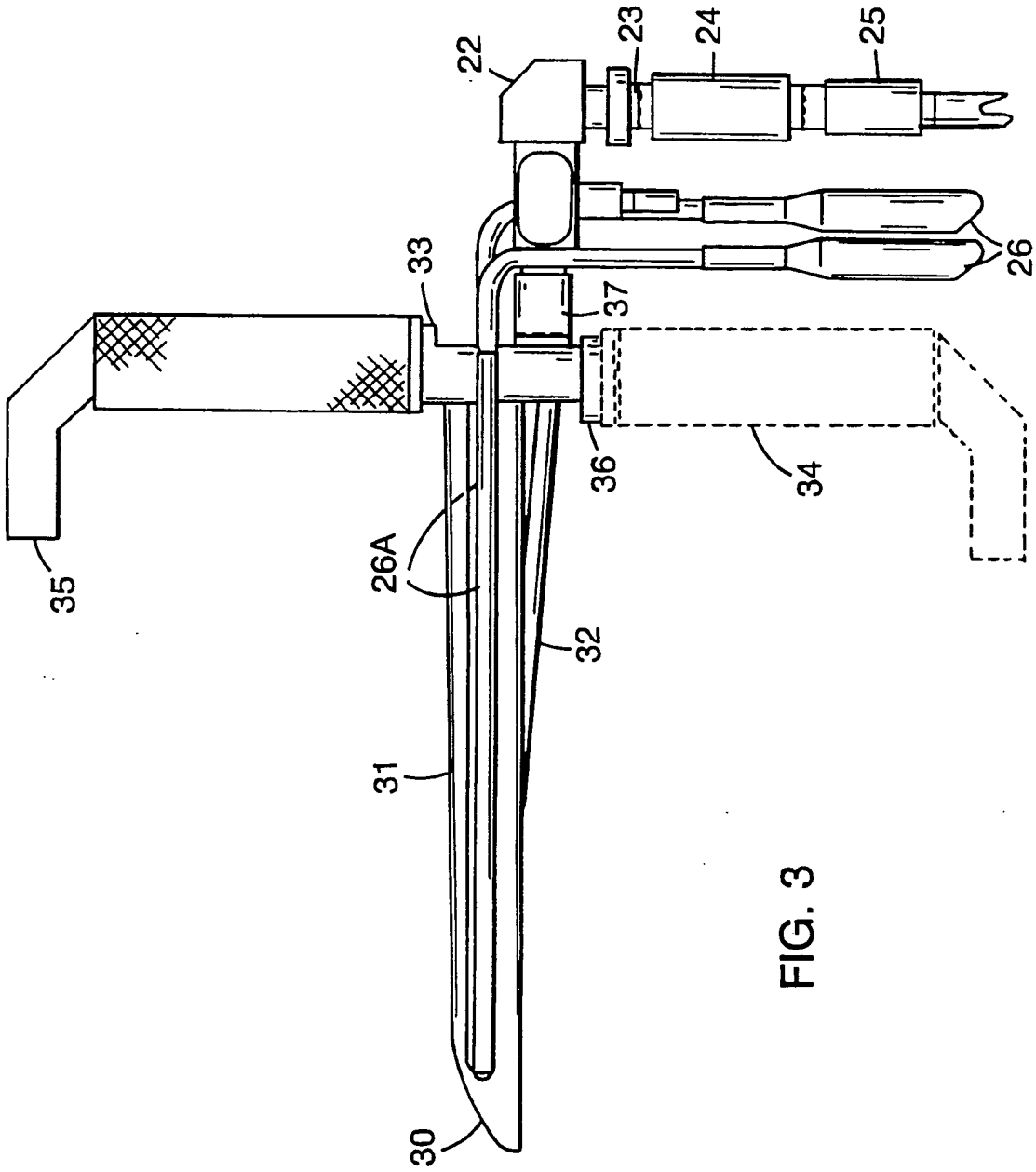


FIG. 3

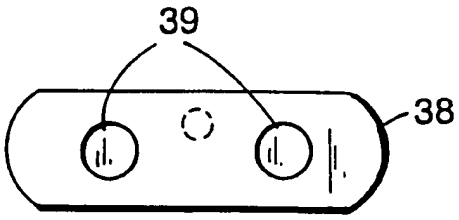


FIG. 4A

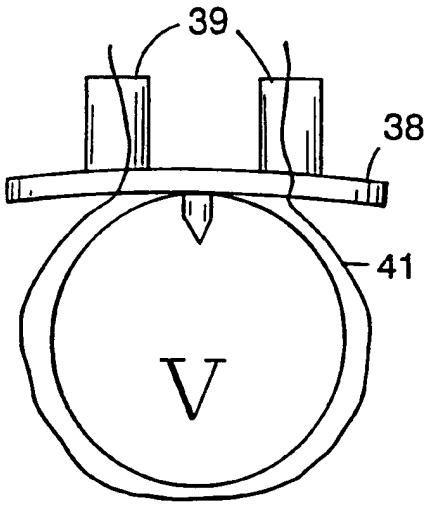


FIG. 4C

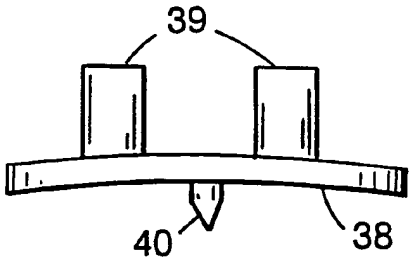


FIG. 4B

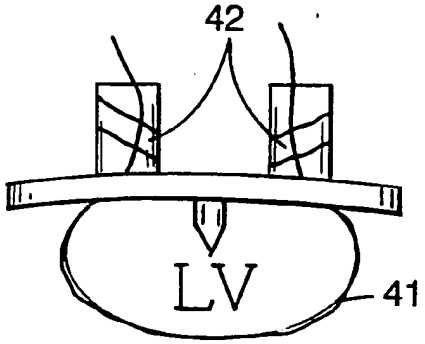


FIG. 4D

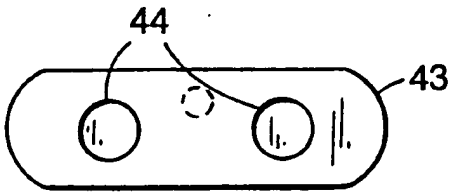


FIG. 5A

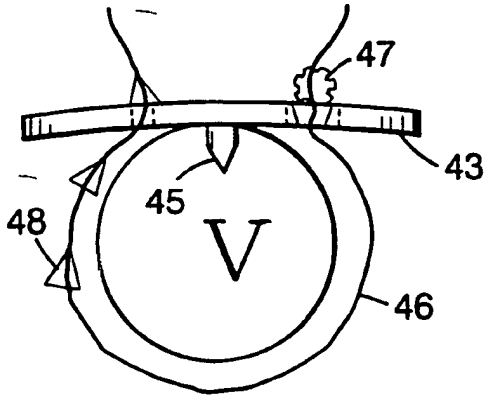


FIG. 5B

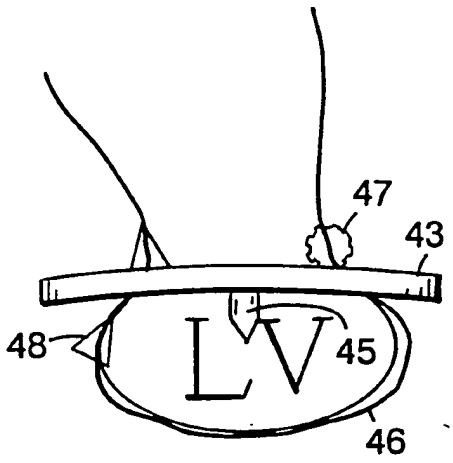


FIG. 5C

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/02888

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(5) :A61B 1/06; 17/02
US CL :128/6, 20
According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 128/6, 20; 128/17, 18, 19, 4; 606/148, 139, 144, 150, 233, 151, 110, 157, 158

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X<br>Y | US, A, 4,263,899 (BURGIN) 28 April 1981. See the entire document. | 1, 4-7, 14, 23<br>2-3, 8-13, 24 |
| Y | US, A, 4,616,635 (CASPAR ET AL.) 14 October 1986. See Figures. | 2, 8-10 |
| Y | US, A, 3,048,308 (SELTZER) 10 July 1962. See the entire document. | 24 |
| X<br>Y | US, A, 4,905,670 (ADAIR) 06 March 1990. See Figures, Camera 32. | 15, 17<br>11, 12, 19, 20 |

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

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| Date of the actual completion of the international search<br>25 MAY 1993 | Date of mailing of the international search report<br>13 JUL 1993 |
| Name and mailing address of the ISA/US<br>Commissioner of Patents and Trademarks<br>Box PCT<br>Washington, D.C. 20231<br>Facsimile No. NOT APPLICABLE | Authorized officer<br>KAREN JALBERT<br>Telephone No. (703) 308-0858 |

Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/02888

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X<br>Y | US, A, 4,799,485 (FUREY ET AL.) 24 January 1989. See col. 3, line 6 and lines 16-56. | 15, 16, 18, 21<br>13 |
| X<br>Y | US, A, 4,762,120 (HUSSEIN) 09 August 1988. See Figure 2, item 30. | 15<br>22 |
| X<br>Y | US, A, 3,993,076 (FOGARTY) 23 November 1976. See the entire document. | 25, 27<br>26, 28 |
| Y | US, A, 4,950,285 (WILK) 21 August 1990. See Figure 1, item 128 Figure 5, item 528. Note "TRIANGULAR ANCHORS" | 28 |